**NATURAL RESOURCES CONSERVATION SERVICE**
**CONSERVATION PRACTICE STANDARD**

# RIPARIAN FOREST BUFFER

**Code 391**

## DEFINITION

An area of trees and/or shrubs located adjacent to and upgradient from water bodies.

## PURPOSE

Improve wildlife and fish habitat by creating shade, providing shelter and fodder and lowering water temperatures. To maintain biodiversity within the ecosystem. Reduce or deter the effects of nutrients, sediment, organic materials, pesticides or other detrimental substance prior to entry into surface waters and ground water recharge areas. Provide a source of detritus and large woody debris for aquatic organisms. Increase potential for streambanks stabilization.

## CONDITIONS WHERE PRACTICE APPLIES

The riparian buffer is a component of a planned resource management system. This practice applies on areas adjacent to permanent or intermittent streams, at the margins of lakes, at the margins of ponds, at the margin of wetlands, and to other areas with ground water recharge.

## CONDITIONS WHERE BUFFERS SHOULD BE CONSIDERED

Where water quality is impaired and adjacent land use contributes to the degradation. Where wildlife habitat enhancement is desired. Where good water quality exists and protection against future impairment is desired. Where streambanks erosion is a concern. Where improvement in streambanks temperature (shading) or woody structure is desired for aquatic production.

## CRITERIA

Riparian forest buffers will be designed to encourage sheet flow and infiltration and impede concentrated flow. The location, layout and density will accomplish the intended purpose and function.

Depending upon purpose, riparian forest buffers will consist of three zones. Buffer widths (stream side zones), may vary depending mainly on slope of land between disturbed area and stream or other water body, but not less than the minimum distances for each zone.

Minimum Spacing Criteria for Riparian Forest Buffer Zones[a/]

| Slope | Recommended Width/Zone (feet) | | | |
|---|---|---|---|---|
| % | 1 | 2 | 3 | Total |
| 0-15 | 15 | 20 | 20 | 55 |
| 20 | 19 | 23 | 23 | 65 |
| 25 | 21 | 27 | 27 | 75 |
| 30 | 23 | 31 | 31 | 85 |
| 35 | 25 | 35 | 35 | 95 |
| 40 | 29 | 38 | 38 | 105 |
| 45 | 33 | 41 | 41 | 115 |
| 50 | 35 | 45 | 45 | 125 |
| 55 | 37 | 49 | 49 | 135 |
| 60+ | 41 | 52 | 52 | 145 |

[a/] For intermittent channels use minimum width.

Zone 1 will begin at the normal water line, or at the top of a bank, and extend for all purposes a minimum of 15 feet measured horizontally on a line perpendicular to water body. Zone 2 consists of an additional strip of land beginning at the outer edge of Zone 1. For all purposes, Zone 2 will occupy a minimum width of 20 feet measured horizontally on a line perpendicular to the water body or as specified. The width must be increased in areas with high production of sediment or nutrients. Zone 3 will begin at the outer edge of Zone 2 and have a minimum width of 20 feet measured horizontally on a line perpendicular to the water body. To maintain biodiversity within the ecosystem, use Zone 1 and Zone 2.

Concentrated or pipe flows needing treatment must be converted to sheet flow or subsurface flows. Outflow from subsurface drains needing treatment must not be allowed to pass through the riparian forest in pipes or tile thus circumventing the treatment process.

Zone 1

Zone 1 will create a stable ecosystem adjacent to the water's edge, provide soil/water contact area to facilitate nutrient buffering process, provide shade to moderate and stabilize water temperature encouraging the production of beneficial algae forms and to contribute necessary detritus and large woody debris to the stream ecosystem. Special attention must be given to toe erosion and upper bank failure.

Zone 1 will use species that produce large crowns to provide a minimum of 30% shade along 1st to 4th order streams (page 391-4).

Dominant vegetation will consist of existing or planted trees, shrubs and grass species and such plantings as necessary for streambanks stabilization during establishment period. Indigenous species are preferred but other species can be used. Nitrogen fixing species should be discouraged where nitrogen removal or buffering is desired. Large trees are valued for their detritus and large woody debris contributions to the stream ecosystem. Occasional removal of some trees and shrub products may be permitted for maintenance purposes if water quality value can be protected.

To improve wildlife and fish habitat survey wildlife present and select species that can improve their environment. If more biodiversity is desired consider Zone 2 for this purpose.

Livestock shall be excluded from Zone 1 except for designed stream crossings. Stream crossings will be open to cattle only during passing time.

Pests present in the site must be controlled as necessary to achieve and maintain the intended purpose.

Zone 2

Zone 2 will provide necessary contact time and carbon energy source for buffering process to take place and to provide for long term sequestering of nutrients.

Predominant vegetation will be composed of existing or planted riparian trees and shrubs suitable to the ecosystem (pages 391-5 and 391-6). Indigenous multipurpose tree species are preferred but other species can be used. Nitrogen fixing species should be discouraged where nitrogen removal or buffering is desired.

Sustainable use of resources is permitted; thus management for wildlife habitat, aesthetics, and harvesting some products are compatible secondary objectives as long as the management for the secondary objectives does not jeopardize the primary function of this practice. Agroforestry practices such as systematic harvesting for food, fiber, medicinal products, shade tolerant aromatic plants and cut flowers, and to maintain vigorous growth and leaf litter replacement and to remove nutrients and pollutants sequestered in the wood of the trees could be incorporated.

Livestock shall be excluded from Zone 2 except for designed stream crossings. Stream crossings will be open to cattle only during passing time.

Concentrated flow erosion or mass soil movement shall be controlled in the up-gradient area immediately adjacent to Zone 2 prior to establishment of the riparian forest buffer.

Zone 3

Zone 3 may not be needed for all purposes but is a requirement for purpose 3 when: a) there is an area where high erosion is evident or potential to occur and, b) where ephemeral concentrated flows need to be converted back to sheet flows.

Riparian forest buffers for purpose 3 will be designed to filter surface runoff as sheet flow and down slope subsurface flow which occurs as shallow ground water. Zone widths (stream side zones) may vary depending mainly on slope of land between disturbed area and stream or other body, but not less than the minimum distances for each zone.

Vegetation will be composed mainly of dense grasses and forbs (page 391-7). Mow or harvest as necessary to recycle sequestered nutrients, promote vigorous sod and control weed growth.

**PLANS AND SPECIFICATIONS**

Plans and specifications shall be in keeping with this standard and shall describe the specific requirements for properly establishing, managing

and maintaining the Riparian Forest Buffer. Use narrative statements in the conservation plan, or other acceptable documentation. For recommended species for each zone, see attached tables. To provide specifications to the landuser on the establishment of this practice use Job Sheets Critical Area Planting (342), Fence (382), Filter Strip (393), Pasture and Hay Planting (512), Prescribed Grazing (528A), Tree Shrub Establishment (612), and Forage Harvest Management (511). Bioengineering vegetative measures are encouraged (Chapter 18, Engineering Field Handbook).

1. Consider the type and quantity of potential pollutants that will be derived from the drainage area.

2. Select preferably indigenous species adapted to the soils and site factors and their ability to achieve multiple benefits such as: forage, biomass, fruit, nesting, aesthetics, and wildlife habitat improvement. Preservation of native streamside vegetation community is important for streambanks protection.

3. Do not select species that can create a hazard for endangered species in the site like shelter and fodder for predators.

4. Vegetation should remain undisturbed except for removal of trees that represent a hazard to streambanks stability, or individual trees of high value.

5. Consider provisions for mowing and removing vegetation. Planned grazing may be satisfactory in Zone 3, proper grazing use or other harvest methods need to be monitored to ensure that the harvest of the forage is conducted without any impairment to Zone 2.

6. Deposit removed material a sufficient distance from the stream so that it will not be redeposited by high water into the stream.

7. The use of this practice without other conservation practices can result in adverse impacts on buffer vegetation and hydraulics. The expected adverse impacts could be high maintenance costs, periodic need for reestablishment of vegetation, and the delivery of excess nutrients, sediment and other potential pollutants through the buffer by concentrated flows.

8. Consideration must be given to the sequence of practice application needed to protect the riparian forest buffer where erosion or pollutant rates might prohibit the buffers successful establishment.

9. The location, layout and density of the buffer should compliment natural features.

This practice will increase water infiltration and reduce runoff. Plants will decrease evaporation, which may result in an increased ground water percolation and higher water uptake.

This practice will reduce soil erosion and sediment delivery into water bodies. Vegetation will trap the movement of dissolved substances, such as nutrients and other nonpoint sources of pollution from entering downstream watercourses.

**OPERATION AND MAINTENANCE**

Riparian forest buffers must be inspected periodically and protected to maintain the intended purpose from adverse impacts such as: severe storm, excessive vehicular or pedestrian traffic, pest infestation, dumping, pesticide and fertilizer used on adjacent land, livestock damage and fire.

Replacement of dead trees and shrubs, and control of undesirable vegetation will be continued until the buffer is, or will progress to, a fully functional condition.

The use of inputs such as fertilizers, pesticides and others must be in compliance with local and federal laws and regulations and must assure buffer proper function. Whenever possible, inputs must be avoided.

Any harvesting must be scheduled for the drier seasons.

The removal or disturbance of vegetation and litter inconsistent with erosion control and buffering objectives must be avoided.

# Recommended Species for Riparian Forest Buffers
## Zone 1

| Grass | | | | |
|---|---|---|---|---|
| Name | | | Suitable | |
| Local | English | Scientific | Dry | Humid |
| Bambú | Bamboo | *Bambusa vulgaris* | x | x |
| Caña brava | Wildcane | *Gynerium sagittatum* | | x |
| Cohitre | Climbing day flower | *Commelina difusa* | | x |
| Yerba acuática | American cupscale | *Sacciolepsis striata* | | x |
| Yerba de pantano | | *Sacciolepsis striata* | | x |
| Yerba de río | Creeping river grass | *Echinochloa polystachya* | | x |
| Yerba trompetilla | | *Hymenachne amplexicaulis* | | x |

| Shrub | | | | |
|---|---|---|---|---|
| Name | | | Suitable | |
| Local | English | Scientific | Dry | Humid |
| Higuillo | | *Piper aduncum* | | x |
| Mangle blanco | White mangrove | *Laguncularia racemosa* | | x |
| Mangle negro | Black mangrove | *Avicenia germinans* | | x |
| Mangle rojo | American mangrove | *Rhizophora mangle* | | x |
| Uva playera | Sea grape | *Coccoloba uvifera* | x | |
| Uvilla | | *Coccoloba costata* | x | |

| Tree | | | | |
|---|---|---|---|---|
| Name | | | Suitable | |
| Local | English | Scientific | Dry | Humid |
| Almácigo | Turpentine tree | *Bursera simaruba* | x | |
| Bucayo | Mountain immortelle | *Erythrina poeppigiana* | | x |
| Bucayo enano | Erythrina | *Erythrina berteroana* | | x |
| Cabo de hacha | Broomstick | *Trichilia hirta* | x | |
| Cacaillo | Sloanea | *Sloanea berteriana* | | x |
| Camasey | | *Miconia prasina* | x | |
| Capa blanco | Bastard stopper | *Petitia dominguensis* | x | |
| Emajaguilla | Portia tree | *Thespesia populnea* | | x |
| Guama | Sacky sac bean | *Inga laurina* | x | |
| Guaraguao | American musk wood | *Guarea guidonia* | x | |
| Guava | River koko | *Inga vera* | x | |
| Mangle botón | Button mangrove | *Conoparpus erectus* | | x |
| María | Antilles calophyllum | *Calophyllum calaba* | | x |
| Moca | Cabbagebark | *Andira inermis* | x | |
| Palma de sierra | Sierran palm | *Prestoea montana* | | x |
| Palma real | Puerto Rico royal palm | *Roystonea borinqueña* | | x |
| Palo colorado | Swamp titi | *Cyrilla racemiflora* | | x |
| Palo de pollo | Dragon's blood tree | *Pterocarpus officinalis* | | x |
| Pterocarpus | Pterocarpus | *Pterocarpus indicus* | | x |
| Tulipán africano | African tulip tree | *Spathodea campanulata* | | x |
| Ucar | Black olive | *Bucida buceras* | x | |
| Yagrumo hembra | Pumpwood | *Cecropia peltata* | | x |
| Yagrumo macho | Matchwood | *Didymopanax morototoni* | | x |
| | | *Capparis spp.* | | x |

# Recommended Species for Riparian Forest Buffers
## Zone 2

| Grass | | | | |
|---|---|---|---|---|
| Name | | | Suitable | |
| Local | English | Scientific | Dry | Humid |
| Cohitre | Climbing day flower | *Commelina difusa* | | x |
| Limoncillo | Lemon grass | *Cymbopogon citratus* | | x |

| Forb | | | | |
|---|---|---|---|---|
| Name | | | Suitable | |
| Local | English | Scientific | Dry | Humid |
| Alpinia | Red ginger | *Alpinia spp.* | | x |
| Anturio | Laceleaf | *Anthurium andreanum* | | x |
| Culantro | Coriander | *Coriandrum sativum* | | x |
| Gengibre antorcha | Grand turmeric | *Etlingera elatior* | | x |
| Llantén | Common plantain | *Plantago major* | | x |
| Malanga | Coco yam | *Colocasia esculenta* | | x |
| Parcha | Golden bellapple | *Passiflora laurifolia* | x | x |
| Perejil | Parsley | *Petroselinum crispum* | | x |
| Plátano de Indio | Lobsterclaw | *Heliconia spp.* | | x |
| Romero | Rosemary | *Rosmarinus officinalis* | | x |
| Zamia | | *Zamia pumila* | | x |

| Shrub | | | | |
|---|---|---|---|---|
| Name | | | Suitable | |
| Local | English | Scientific | Dry | Humid |
| Achiote | Anatto | *Bixa orellana* | x | |
| Albahaca | Sweet basil | *Ocimum basilicum* | | x |
| Anon | Sugar apple | *Annona squamosa* | x | x |
| Canela | Pepper cinnamon | *Canella winterana* | x | |
| Higuillo | | *Piper aduncum* | | x |
| Mabí | Soldier wood | *Colubrina elliptica* | x | |
| Malagueta | Bayrum tree | *Pimenta racemosa* | | x |
| Mejorana | False thyme | *Lippia micromera* | x | x |
| Pimienta | Allspice | *Pimenta dioica* | | x |
| Uva playera | Sea grape | *Coccoloba uvifera* | x | |
| Yerba buena | Hairy mint | *Mentha nemorosa* | | x |

| Shrub/Tree | | | | |
|---|---|---|---|---|
| Name | | | Suitable | |
| Local | English | Scientific | Dry | Humid |
| Cítricas | Citrus | *Citrus spp.* | x | x |
| Corazón | Pond apple | *Annona glabra* | | |
| Guanábana | Soursop | *Annona muricata* | | |

| Tree | | | | |
|---|---|---|---|---|
| Name | | | Suitable | |
| Local | English | Scientific | Dry | Humid |
| Achiotillo | | *Alchornea latifolia* | | x |
| Aguacate | Avocado | *Persea americana* | x | x |
| Algarroba | Strikingtoe | *Hymenaea courbaril* | x | |
| Almácigo | Turpentine tree | *Bursera simaruba* | x | |
| Almendro | Indian almond | *Terminalia catappa* | | x |
| Ausubo | Bulletwood | *Manilkara bidentata* | | x |
| Bucayo | Mountain immortelle | *Erythrina poeppigiana* | | x |
| Bucayo enano | Erythrina | *Erythrina berteroana* | | x |
| Cacaillo | Sloanea | *Sloanea berteriana* | | x |
| Camasey | | *Miconia prasina* | x | |
| Caoba dominicana | West Indian mahogany | *Swietenia mahagoni* | x | |
| Caoba hondureña | Honduras mahogany | *Swietenia macrophylla* | | x |
| Capa blanco | Bastard stopper | *Petitia dominguensis* | x | |
| Capa prieto | Spanish elm | *Cordia alliodora* | | x |
| Cedro hembra | Spanish cedar | *Cedrela odorata* | | x |
| Cobana negra | | *Stahlia monosperma* | x | |
| Cupey | Scotch attorney | *Clusia rosea* | x | x |
| Emajaguilla | Portia tree | *Thespesia populnea* | | x |
| Espino rubial | Yellow prickle | *Zanthoxylum monophyllum* | | x |
| Eucalipto limón | Lemon scented gum | *Eucalyptus citriodora* | | x |
| Guama | Sacky sac bean | *Inga laurina* | x | |
| Guano | West Indian balsa | *Ochroma pyramidale* | | x |
| Guaraguao | American musk wood | *Guarea guidonia* | x | |
| Guayacán | Common lignumvitae | *Guajacum officinale* | x | |
| Guayacán blanco | Holywood lignumvitae | *Guajacum sanctum* | x | |
| Higuero | Calabash | *Crescentia cujete* | x | x |
| Mamey | Mamme apple | *Mammea americana* | x | x |
| Mangó | Mango | *Mangifera indica* | x | x |
| María | Antilles calophyllum | *Calophyllum calaba* | | x |
| Moca | Cabbagebark | *Andira inermis* | x | |
| Nemoca | | *Ocotea spathulata* | | x |
| Níspero | | *Manilkara zapota* | | x |
| Palma de sierra | Sierran palm | *Prestoea montana* | | x |
| Palma real | Puerto Rico royal palm | *Roystonea borinqueña* | | x |
| Panapén | Breadfruit | *Artocarpus altilis* | | x |
| Pendula | Florida fiddlewood | *Citharexylum fruticosum* | x | |
| Pino Hondureño | Honduras pine | *Pinus caribaea* | | x |
| Pomarrosa | Melabar plum | *Synzygium jambos* | | x |
| Pterocarpus | Pterocarpus | *Pterocarpus indicus* | | x |
| Quenepa | Spanish lime | *Melicoccus bijugatus* | x | x |
| Roble nativo | White cedar | *Tabebuia heterophylla* | | x |
| Tabonuco | Candle tree | *Dacryodes excelsa* | | x |
| Tachuelo | Fustic | *Pictetia aculeata* | x | |
| Teca | Teak | *Tectona grandis* | x | x |
| Tulipán africano | African tulip tree | *Spathodea campanulata* | | x |
| Ucar | Black olive | *Bucida buceras* | x | |
| Violetas | Violet tree | *Polygala cowellii* | x | |
| Yagrumo hembra | Pumpwood | *Cecropia peltata* | | x |
| Yagrumo macho | Matchwood | *Didymopanax morototoni* | | x |
| | | *Cordia nitida* | x | |
| | | *Jacaranda mimosifolia* | | x |
| | | *Spondias purpurea* | | x |
| | | *Synzygium malaccense* | | x |
| | | *Thespesia grandiflora* | x | x |

# Recommended Species for Riparian Forest Buffers
## Zone 3

| Grass | | | | |
|---|---|---|---|---|
| Name | | | Suitable | |
| Local | English | Scientific | Dry | Humid |
| Yerba colorada | Carpet grass | *Axonopus compressus* | | x |
| Yerba huracán | Hurricane grass | *Bothriochloa pertusa* | x | |
| | | *Brachiaria humidicola* | | x |
| Malojillo | Paragrass | *Brachiaria mutica* | | x |
| Yerba bermuda | Bermuda grass | *Cynodon dactylon* | x | x |
| Yerba estrella | Star grass | *Cynodon nlemfuensis* | | x |
| Yerba pajón | Kleberg's bluestem | *Dichanthium annulatum* | x | |
| Yerba pangola | Pangola grass | *Digitaria decumbens* | | x |
| Malojilla | Caribgrass | *Eriochloa polystachya* | | x |
| Yerba torcida | Tanglehead | *Heteropogon contortus* | x | |
| Yerba melao | Molassesgrass | *Melinis minutiflora* | | x |
| Yerba bahía | Bahia grass | *Paspalum notatum* | x | |
| Yerba buffel | Buffel grass | *Pennisetum ciliare* | x | |
| Yerba cerrillo | Smut grass | *Sporobolus indicus* | x | x |
| Yerba San Agustín | St. Augustine grass | *Stenotaphrum secundatum* | | x |
| Yerba pacholí | Vetiver grass | *Vetiveria zizanioides* | x | x |